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BIOINTENSIVE MANAGEMENT PRACTICES FOR CONTROLLING PINWORM *TUTA ABSOLUTA* (MEYRICK) IN TOMATO CULTIVATION

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ABSTRACT

Field trials were conducted in 20 farmer fields during two consecutive years i.e 2022- 2024 in sangareddy district to evaluate the Biointensive management strategies against pinworm (*Tuta Absoluta* L.) in tomato in comparison with farmers practice. For management of these pest the following recommended practices were suggested to farmers i.e application of neem cake @ 200kg/acre, installation of pheromone traps, sticky traps, *Trichogramma chilonis*, collection and destruction of infested parts and spraying of Azadirachtin 10,000 ppm 2 ml/ lit 30 days after transplanting. Spraying of Emamectin Benzoate @ 0.4 g/ lit 10 days after first spray. Spraying of Lambda cyhalothrin @0.5 ml/ lit 10 days after the second spray was effective. Seasonal incidence studies revealed that the population gradually increased from September and peaked in January (12.3 adults/trap). It was observed that the insect population was higher during the fruit maturity stage. A higher average marketable fruit yield (29.05 t/ha) and 6.7 % yield increase were noted in the demo field over farmers practice (27.21 t/ha) with a benefit -cost ratio of 2.27 and 1.93:1, respectively. It also observed that higher gross returns (3,95,500/ha) and net returns (2,02,000/ha) were recorded in the demo field than farmer's practice (3,64,400/ha and 1,55,845/ha, respectively). The results clearly showed the positive impact of the recommended practices over farmers practices in increasing productivity and reducing the cost of tomato cultivation.

Keywords **:** Biointensive management, Pinworm, Pheromone traps, Neem cake, Azadirachtin.

Introduction

Tomato (*Solanum lycopersicum* L.) is the world's fourth most valuable food crop and produced in almost every country Schreinemachers *et al.* (2018). India accounts for 11% of global tomato production and is the world's second-largest producer after China FAO, (2020). In India tomato production about 208.19 lakh tonnes, from an area of 0.85 million hectares NHB, (2018). Unfortunately, the tomato plant is highly susceptible to many insect pests and plant pathogens as the fruit is tender and soft. The tomato Leaf miner or Tomato Pinworm, scientifically known as *Tuta absoluta* (Meyrick), poses a significant threat to tomato crops across various regions, notably in Latin America and the Mediterranean basin. Its aggressive behavior, ability to produce multiple generations in a short span, high reproductive potential, and increased resistance to insecticides contribute to its status as a major pest in new territories. In India, this invasive pest first appeared in the Malnad and Hyderabad regions of Karnataka in November 2014, causing substantial yield losses ranging from 50-60%. Telangana, with its 42,761 acres of tomato cultivation and an annual production of 499,769 metric tons (as per Telangana Horticulture Department 2021- 22), witnessed the arrival of this pest during the same period.

In the tomato-growing blocks of Sangareddy district, field surveys were conducted to evaluate the prevalence and severity of the pinworm infestation. Farmers typically resort to synthetic insecticides for pinworm control, but their widespread use has resulted in pest resistance and harmful pesticide residues on the fruits. This ongoing study aims to bridge the gap between recommended demonstration packages and

actual farmer practices in pinworm management within tomato crops. Furthermore, it seeks to evaluate the effectiveness of demonstration in tomato cultivation by implementing biointensive pest management practices for pinworm control. The primary objective is to mitigate yield losses, reduce cultivation expenses, and minimize pesticide residues.

Materials and Methods

Assessment of biointensive pest management strategies was conducted to combat pinworm infestations in tomato crops within the villages of Sangareddy district, Telangana state, particularly focusing on Nallavelli village in the Patancheru urban mandal. Spanning two consecutive Rabi seasons from 2022 to 2024, these trials covered a total area of 8 hectares distributed across 20 farmer fields. The primary objective was to enhance farmers understanding of pinworm identification and its effective management techniques.

Table 1: Practices followed in Demo and check:

Demo	Check
Suggested Practices: Soil application of neem cake @ 200 kg/acre as basal dose in main field. Installation of *Trichogramma chilonis* @1 card/acre from 30 DAT for three times at 15 days interval. Installation of Pheromone traps @ 12/acre for mass trapping in nursery and main field. Installation of Sticky traps @ 8/acre. When moth catches in the trap is exceeding 20-30 moths/trap/week, Spraying with Azadirachtin 10,000 ppm @ 2 ml/lit of water. Two sprays at weekly intervals. **Need based pesticide application:** Spraying of Emamectin Benzoate @ 0.4 g/ lit and Lambda cyhalothrin @0.6ml/ lit.	Soil application of FYM @ 12t/ha. Borax application @ 8kg/ acre. Spraying of Profenophos @ 2ml/lit, Acephate @ 1.5 g/lit, Lambda cyhalothrin @0.6ml/ lit, Applying, Acetamiprid @ 0.2 g/lit, Flonicamid @ 0.3 g/lit of water.

Farmers were chosen through a participatory selection process facilitated by KVK scientists within tomato growing blocks. They were trained on the package of practices recommended by SHU (State Horticultural University) from sowing till harvesting like the quality seeds, seed treatment with bio control agents (*Trichoderma*), recommended dose of fertilizers, mulching, integrated pest management practices in tomato. They implemented management modules aimed at controlling pinworm infestations in their fields. Technical intervention covered an area of 0.4 hectares for each farmer, where farmers followed all the recommended practices suggested by scientists including the judicious use of chemicals as needed. An adjacent 0.4-hectare area served as a control, where farmers relied solely on chemical pesticides for comparison with the demonstration plots.

The moth population was monitored from the time of transplanting using sex pheromone traps (Pheromone Chemicals Ltd). Ten traps were placed per acre, above the ground, and adjusted to the height of the plant canopy every week. The pheromone dispensers in the traps were replaced every four weeks. The number of moths caught in each trap was counted weekly throughout the growing season of the crop.

In the present study, data on yield, pest incidence, production costs, and gross returns, as well as extension gap, technology gap, and technology index, were collected from demonstrated plots and local check plots of tomato for analysis and data interpretation. The statistical tools to estimate the Percent pest incidence, percent yield increase, technology gap, extension gap, and the technology index, the formulation as mentioned below used as suggested by Samui *et. al.* (2000).

Pinworm incidence (%) = Number of fruits infested/ Total number of fruits x 100

Per cent increase in yield = Demonstration yield - Farmers practice yield x 100 /Farmers practice yield.

Technology gap = Potential yield-Demonstration yield.

Extension gap = Demonstration yield-Yield under existing practice

Technology index = Potential yield-Demonstration yield x 100 /Potential yield.

Table 2 : Extension activities were conducted in the selected village.

S. No.	Name of activity	No.	Beneficiary
1.	Training programme conducted on campus	1	22
2.	Training programmes conducted off campus	2	64
3.	Visits to farmer fields	10	35
4.	Impact study	1	24
5.	Method demonstrations on installation of pheromone traps, sticky traps, Trichocards	2	36
Total			181

Table 3: Level of usage and gap in adoption of technology in Pin worm management in Tomato

Sl no	Ecological Practices for Pinworm management	Level of adoption	
		Demo	Check
1	Soil application of neem cake @ 200 kg/acre as basal dose in main field.	Adopted	Not Adopted
2	Growing border crop viz., Sorghum or Maize	Adopted	Not Adopted
3	Mechanical collection and destruction of affected plants	Adopted	Not Adopted
4	Installation of *Trichogramma chilonis* @1 card/acre from 30 DAT for three times at 15 days interval.	Adopted but not within the specified time.	Not Adopted
5	Installation of Pheromone traps @ 12/acre for mass trapping in nursery and main field. Installation of Sticky traps @ 8/acre.	Adopted	Not Adopted
6	When moth catches in the trap is exceeding 20-30 moths/trap/week, Spraying with Azadirachtin 10000 ppm @ 2 ml/lit of water. Two sprays at weekly intervals.	Adopted	Not Adopted
7	Need based Spraying of Emamectin Benzoate @ 0.4 g/ lit and Rynaxpyre @ 0.3 ml/ lit of water.	Adopted	Adopted

Result and Discussion

Considering the situation and dialogue with the farmers, KVK Scientist suggested the implementation of Biointensive management practices for pinworm in tomatoes and trainings were conducted to interested farmers on pinworm life cycle, nature of the damage, and different host species. Follow-up visits were made and conducted method demonstrations, and field days were organized. Total 181 members benefited through various extension methodologies carried out in cluster villages by KVK Scientist to import the knowledge on the management of pinworm in tomatoes (Table 2).

Table 4 : Seasonal occurrence of leaf miner (*Tuta obsoluta*) in the field during 2022-2023.

Month	Leaf infestation (%)	Fruit infeatation (%)	Trap catches
August	0	0	0
September	1.2	0	1.1
October	3	4.76	3
November	5	10.4	7.9
December	11.8	13.04	11.6
January	6.6	8.8	12.3
February	3.6	4.8	9.2
Average	4.45	5.97	6.44

Data from Table No. 4 reveals that the incidence of the tomato pinworm started during the vegetative stage in September, with 1.2% leaf infestation, and peaked in December with 11.8% infestation. The mean percentage of leaf damage was 4.45% throughout the crop growth period, which aligns with the findings of Nayana *et al.* (2018).

Fruit infestation was first noticed in October, and the percentage of infestation throughout the crop period ranged from 4.76% to 13.04%, with a mean of 5.97% fruit infestation. The maximum fruit damage of

13.04% was recorded in December when trap catches reached 11.6 adults per trap. The insect population was highest during the fruit maturity stage, and the results are consistent with the findings of Kumar *et al.* (2020).

Moth catches began in September and continued until the final harvest of the crop. The number of moths ranged from 1.1 to 12.3 per trap. The population gradually increased from September, reaching its peak in January with a mean of 12.3 adults per trap. Afterward, the pest population gradually declined, reaching 9.2 moths per trap in February. These results are in agreement with the findings of Portakaldali *et al.* (2013).

Fruit yield recorded in 2022-23 was 14 t/ha and 12.30 t/ha for the demo and check plots, respectively, resulting in a yield increase of 13.82%. In contrast, for the year 2023-24, the recorded yields were 44.10 t/ha for the demo and 42.13 t/ha for the check, representing a 5% increase in yield (Table 5). Table 6 displays the benefit-cost ratio for both study years, with a pooled B: C ratio reported as 2.27 for the demo and 1.93 for the check.

Table 5: Fruit Yield, Technology gap, Extension gap and Technology index of Pinworm Management in Tomato.

Year	Fruit Yield (t/ha)		Technology gap (t/ha)	Extension gap (t/ha)	Technology index
	Dem	Check			
2022-2023	14.0	12.30	56	1.7	80
2023-2024	44.10	42.13	25.9	1.97	37
Average yield	29.05	27.215	40.95	1.835	58.5

Potential Yield: 70 t/ha.

Table 6: Cost Economics of Assessment on Pinworm Management in Tomato

Parameters	2022-2023		2023-2024		Pooled data	
	Demo	Check	Demo	Check	Demo	Check
Cost of investment	1,21,255	1,27,850	2,65,750	2,89,350	1,93,502.5	2,08,600
Gross income	3,50,000	3,07,500	4,41,000	4,21,300	3,95,500	3,64,400
Net income	2,28,750	1,79,740	1,75,250	1,31,950	2,02,000	1,55,845
B: C Ratio	2.88	2.40	1.66	1.46	2.27	1.93

Technology gap

The technology gap was 56 t/ha and 25.9 t/ha for the years 2022-23 and 2023-24, respectively. On average, the technology gap for these two years was 40.95. This discrepancy may stem from variations in soil fertility, individual farmers managerial skills, and the climatic conditions of the selected area. Hence, location-specific recommendations are necessary to bridge these gaps and this conforms with the results of Chaitanya *et al.* (2022).

Extension gap

The extension gap was 1.7 t/ha and 1.97 t/ha in 2022-23 and 2023-24, respectively. The average extension gap recorded was 1.835. This underscores the need to educate farmers through various techniques to promote the adoption of improved agricultural production technologies and reverse the trend of widening extension gaps. Increased utilization of the latest production technologies, coupled with high-yielding varieties/hybrids, will likely mitigate this concerning trend of widening extension gaps above findings are similar with findings of Singh and Bisen (2020).

Technology Index:

The technology index shows the feasibility of the demonstrated technology at the farmer's field. The technology index varied from 37 to 80 (Table 5). On an average technology index of 58.5 per cent was observed during the two years of assessment, which shows the effectiveness of technical interventions for yield increase. These findings were in line with the findings of Shankar *et al.* (2022).

Conclusion

Tomato growers primarily rely on chemical insecticides to control pinworm, leading to increased cultivation costs and poor-quality produce. However, the adoption of biointensive management strategies for pinworm reduced the indiscriminate use of insecticides. Pest population monitoring through pheromone traps helped in applying pesticides at the correct time. As a result, most farmers became aware of the recommended practices for managing pinworm in tomatoes after technical interventions on their fields. The yield, net return, and B:C ratio were higher in the demonstration plots compared to the farmers usual practices.

The trials conducted by DDS-KVK in Sangareddy district on tomato crop effectively managed the leaf miner, which affects all stages of the crop from vegetative to fruiting. Farmers were educated on key aspects such as identifying the pest, recognizing symptoms, and applying the right methods and timing for control. This education significantly increased farmers income by reducing losses caused by the leaf miner, *Tuta absoluta*, in tomatoes.

Plate 1: Field Diagnostic Visits to Demo

Plate 2 : Inputs Distribution to farmers during

Plate 3 : Training Programs conducted on Pinworm Management practices during

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